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GB 1410711
GB 1348660
GB 1256103
GB 1253682
GB 1207267
GB 1201066
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GB 1053220
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(54) **Transparent thermoplastic laminate**

(57) Composite transparent thermoplastic material for making agricultural greenhouses comprises at least two superposed films, the bottom film being made of a thermoplastic material with great resistance to the aging caused by ultra-violet radiation and the other(s) being made of a thermoplastic material that is opaque to infra-red radiation with a wavelength of over 8 microns. The material has a useful life longer than that of single films of the same thickness and the reduction in light transmission with the passage of time, in so far as it is due to corrosion, may periodically be made good by replacing individual layers. A liquid such as glycerin may be included between the films. The layers may be of polyethylene, ethylene-vinyl acetate copolymer or plasticised pvc.

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SPECIFICATION

Transparent thermoplastic

The invention relates to agricultural greenhouses and transparent thermoplastic material for making them.

It is known that thermoplastic films can be used for making agricultural greenhouses. The thermoplastic materials used for preparing these films include polyethyine, copolymers of ethylene and vinyl acetate, and plasticised polyvinyl chloride. Polyethylene films, by virtue of their resistance to aging caused by ultraviolet radiation, may remain in service for several years and thus have the advantage of a long life. However, since polyethylene is transparent to infre-red radiation with a wavelength of over 8 microns, such films do not retain the heat, which is re-emitted at night in the form of such radiations within the greenhouse. This makes the harvests less early and is detrimental to the yields obtained. Films made of copolymers of ethylene and vinyl acetate and films made of plasticised polyvinyl chloride have the advantage of being more opaque to infra-red radiation with a wavelength of over 8 microns, but the life of such films is notoriously shorter, generally not more than two years.

The main disadvantage of the thermoplastic films used for making agricultural greenhouses is the fact that, however stable they are to light, the amount of light transmitted through them decreases in the course of time as a result of corrosion, which causes scoring on the surface, mainly the external surface exposed to the weather.

The present invention provides a composite transparent thermoplastic material suitable for making agricultural greenhouses and comprising at least two superposed films, the film intended to face the interior of the greenhouse, herein called the lowermost film, being made of a thermoplastic material with great resistance to the aging produced by ultraviolet radiation, the other film or films being made of a thermoplastic material that is opaque to infra-red radiation with a wavelength of over 8 microns.

The composite material according to the invention, while having a longer life than simple films of the same thickness, has the advantage of being opaque to infra-red radiation with a wavelength of over 8 microns. It can be used under conditions such that the reduction in light transmission in the course of time, for which corrosion is responsible, is periodically made good.

A transparent composite thermoplastic material in which the lowermost film is made up of a film of thermoplastic material with great resistance to aging caused by ultraviolet radiation and is covered with one, or preferably more than one, film of a thermoplastic material opaque to infra-red radiation with a wavelength of over 8 microns, will retain its initial transparency while in use with the passage of time, if the top film is removed at specified intervals of time, e.g. every year. The durability of the lowermost film is also increased by the fact that the ultraviolet radiation is stopped by the other films.

In a particularly advantageous embodiment of the invention, a liquid compound that is opaque to infra-red radiation with a wavelength of over 8 microns is incorporated between the various films. Incorporation of such a compound between the films not only increases the opacity of the composite material to infra-red radiation with a wavelength of over 8 microns but also considerably increases initial light transmission.

The thickness of the lower film is generally from 100 to 300 microns and that of the other films generally from 20 to 100 microns.

The number of films depends on their thickness. It should be such that the maximum thickness of the material is 1 mm; the optimum thickness is generally from 0.25 to 0.50 mm.

Thermoplastic materials suitable for forming the lowermost film include those based on polythene, copolymers of ethylene and vinyl acetate where the weight of vinyl acetate is from 3 to 20%, and plasticised polyvinyl chloride where the weight of plasticiser is from 5 to 40%.

Thermoplastic materials suitable for forming the other film or films include those based on copolymers of ethylene and vinyl acetate where the weight of vinyl acetate is from 7 to 30%, and plasticised polyvinyl chloride where the weight of plasticiser is from 10 to 30%.

Films suitable for preparing a composite material according to the invention may be chosen from those known for their use in making agricultural greenhouses. The polymers mentioned are used for preparing the thermoplastic materials which make up the films, and ingredients such as stabilisers and possibly lubricants normally used for preparing such films can be added where appropriate. Thus the polymers are stabilised against ultraviolet radiation by means of know stabilisers such as benzophenone derivatives and organic complexes of nickel. In the case of plasticised polyvinyl chloride, at least one heat-stabiliser, such as a barium salt, a cadmium salt or an organic tin salt, and at least one lubricant, such as stearic acid, is used. Plasticisers that should particularly be mentioned are dioctyl phthalate, octyl adipate, octyl sebacate, tricresyl phosphate and epoxidised soya oil.

The liquid compound suitable for incorporation between the films may be any liquid that is chemically inert relative to the thermoplastic materials making up the films. A particularly preferred compound is glycerin. The compound may be coloured to filter out certain radiation with a view to modifying the photo-synthesis of the crops in the greenhouses.

For the preparation of the composite material according to the invention, each of the constituent films is manufactured separately, e.g. in roll form, using conventional methods such as blow extrusion. Each of the rolls is then unwound and all the films are simultaneously cold-calendered, possibly with incorporation of the liquid compound between them. The calendering pressure spreads any liquid present right across the width of the films. To facilitate removal of the top film each year, it is recommended to provide only weak adhesion between the films; liquid/solid interfacial tension is

sufficient to give such adhesion.

In practice, materials measuring up to several metres in width are being used increasingly for making agricultural greenhouses, for economic reasons. The preferred material of the invention is consequently one that can be manufactured in a large width and therefore by the blow extrusion process. It follows that the polymers preferably used are those based on polyethylene.

Some examples of the invention will now be given.

EXAMPLE 1

A composite material according to the invention is produced; films of it are obtained by the blow extrusion process and vary in width from 1 to 16 metres. The lowermost film is 200 microns thick and based on polyethylene, which is stabilised against ultraviolet radiation by means of benzophenones or benzothiazoles, either alone or associated with organic complexes of nickel. The other films, four in number and 50 microns thick, are based on copolymer of ethylene and vinyl acetate, containing 85% by weight of ethylene and 15% by weight of vinyl acetate; the copolymer is stabilised against ultraviolet radiation by the same stabilisers.

Whereas the maximum useful life of a greenhouse made with a single film 400 microns thick of the same type as the lowermost film or one of the other films in the composite material is not more than 4 or 5 years, the life of a greenhouse made from the said composite material may reach 7 to 8 years.

If the top film is removed every year for 4 years, the remaining material will regain the transparency of the new material.

EXAMPLE 2

The same composite material as in Example 1 is made, but a layer of glycerin is incorporated between the various films.

This composite material can be used to make a greenhouse having the same advantages as that obtained from Example 1. However, its initial transparency is better and, since it is more opaque to infra-red radiation, heat retention inside the greenhouse is also improved. This results in earlier harvesting and a higher yield.

CLAIMS

1. A composite transparent thermoplastic material suitable for making agricultural greenhouses and comprising at least two superposed films, the film intended to face the interior of the greenhouse, herein called the lowermost film, being made of a thermoplastic material with great resistance to the aging produced by ultraviolet radiation, the other film or films being made of a thermoplastic material that is opaque to infra-red radiation having a wavelength of over 8 microns.

2. Material as claimed in Claim 1, in which a liquid that is opaque to infra-red radiation with a wavelength of over 8 microns is incorporated between the various films.

3. Material as claimed in Claim 2, in which the liquid incorporated between the various films is glycerin.

4. Material as claimed in Claim 2 or 3, in which the liquid is coloured.

5. Material as claimed in any one of Claims 1 to 4, in which the thickness of the lowermost film is from 100 to 300 microns and that of the other films from 20 to 100 microns.

6. Material as claimed in any one of Claims 1 to 5, that is less than 1 mm thick.

7. Material as claimed in Claim 6 that is from 0.25 to 0.50 mm thick.

8. Material as claimed in any one of Claims 1 to 7, in which the thermoplastic material forming the lowermost film is based on polyethylene, a copolymer of ethylene and vinyl acetate in which the weight of vinyl acetate is from 3 to 20%, or plasticised polyvinyl chloride in which the weight of plasticiser is from 5 to 40%.

9. Material as claimed in any one of Claims 1 to 8, in which the thermoplastic material forming the other film or films is based on a copolymer of ethylene and vinyl acetate in which the weight of vinyl acetate is from 7 to 30%, or a plasticised polyvinyl chloride in which the weight of plasticiser is from 10 to 30%.

10. Material as claimed in Claim 1 substantially as hereinbefore described in Example 1 or 2.

11. An agricultural greenhouse made with the material as claimed in any one of Claims 1 to 10.

12. A method of carrying out forced cultivation and protection of crops of vegetables, flowers and fruit, in which material as claimed in any one of Claims 1 to 10 is used as covering and/or protective components.

13. A method as claimed in Claim 12, in which the top film is removed at specified intervals of time.

14. A method as claimed in Claim 13, in which the top film is removed annually.

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